ESRF	**Experiment title:** **Structural refinement of the MgSi03-type perovskites at Earth s lower mantle pressures**	**Experiment number:** HS325
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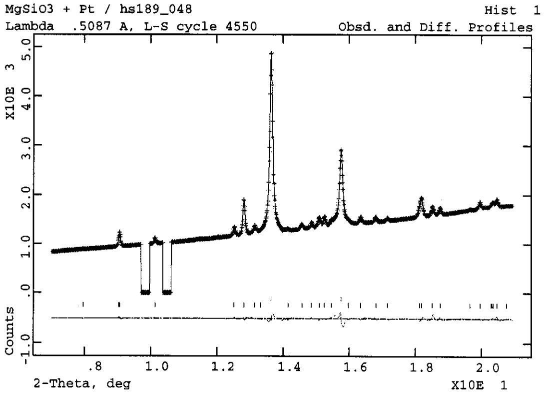
Report:

The goal of this project was to investigate the structure behavior of the Earths relevant perovskites under very high-pressure, using a diamond anvil cell coupled with a YAG laser heating. This techniques was proven to be efficient, as shown in our recent publications on the iron structure and on the MgSi03 perovskite equation of state (Andrault et al., 1997; Fiquet et al., 1998).

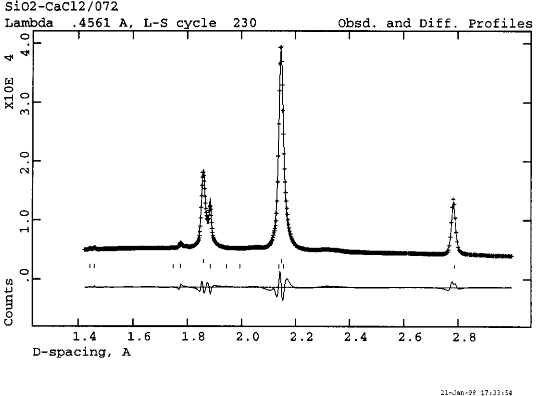
For each additional pressure increase, we thus released the internal stress using the YAG laser heating, before the angle dispersive diffraction analysis. As mentioned in the proposal, the use of platinum is ideal to absorb the YAG laser 1.064 µm radiation, and also to produce an internal calibrant for the pressure measurement. Figure 1 shows an example of the Rietveld fit, for the MgSi03 perovskite.

Figure 1: Rietveld full structure refinement of a diffraction pattern of $MgSiO_3$ at 79.7 GPa integrated from an image using a monochromatic beam tuned to 0.5087 A. Space group Pbnm, a=4.4456(4), b=4.6648(3), c=6.4540(4) in Å, Rwp=1.28% and $R(F^2)$=6.3%. Sample reflections (lower ticks) are mixed with reflections from platinum, used as internal pressure calibrant (upper ticks).

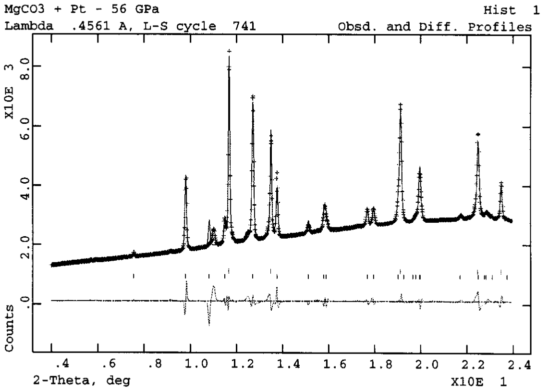


However, we did not spent the total beam-time on the perovskites structural study as a function of composition, but we also studied the structural analysis of Si02 stishovite and MgC03 magnesite in the same pressure conditions. This for the following reasons; (1) We performed at about same time a PVT equation of state of perovskite up to 86 GPa, that made our study faster (see HS330 experimental report), (2) A recent study had just proposed that the Si02 stishovite would undergo an important phase transformation at about 68 GPa (Dubrovinsky et al., 1997). The authors proposed that it would occur with a large volume gain, sufficient to promote the perovskite decomposition into MgSi03 => MgO + Si02. This is of great importance, since it would modify the mineralogical content of the lower mantle, and thus the lower mantle elastic moduli. We thus investigated the Si02 structure up to 120 GPa (1.2 Mbar) using the same technique that releases stress and non-hydrostatic pressure. Figure 2 shows that the Si02 adopts the CaC12 structure above 50 GPa as previously reported in various studies (See Kingma et al., 1995). But, we did not found any phase transformation with large volume variation.

Figure 2 : Lebail refinement of the Si02 CaC12-polymorph (lower ticks) at 66 GPa after laser heating (mixed with Pt, upper ticks). The Rietveld refinement of this experiment is in progress, but intensities already match very well using slight atomic displacement from the original stishovite structure.



(3) We also performed a preliminary study on the high-pressure stability of MgC03 magnesite up to 65 GPa. It is of importance, because this structure is a potential host for oxidized carbon in the Earth's mantle. The next figure represent a Lebail profile of a pattern integrated from an image plate exposed 10 min. on a mixture of MgC03 and Pt. We observed no decomposition (MgC03 => MgO + C02) as a proof of the extended stability field.



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